Class 11 RD Sharma Solutions – Chapter 23 The Straight Lines – Exercise 23.4

Last Updated : 18 Mar, 2021

Question 1. Find the equation of straight line passing through the point (6, 2) and having slope -3.

Solution:

We know $(y - y_1) = m(x - x_1)$

Here, m = *Slope of line* = -3

$x_1 = 6, y_1 = 2$

So, the equation of line is

$\Rightarrow y - 2 = (-3)(x - 6)$

$\Rightarrow y - 2 = -3x + 18$

$\Rightarrow 3x + y - 20 = 0$

Question 2. Find the equation of straight line passing through (-2, 3) and inclined at an angle of 45° with the x-axis.

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We know $y - y_1 = m(x - x_1)$

Here, m = Slope of line = $\tan 45^\circ = 1$

$x_1 = -2, y_1 = 3$

So, the equation of line is

$\Rightarrow y - 3 = 1(x - (-2))$

$\Rightarrow y - 3 = x + 2$

$\Rightarrow x - y + 5 = 0$

Question 3. Find the equation of straight line which divides the join of points (2, 3) and (-5, 8) in the ratio 3:4 and is also perpendicular to it.

Solution:

Let the point at which the line divides the join of points (2, 3) and (-5, 8) in the ratio 3:4 be $P(x_1, y_1)$

P(x1, y1) = \frac{(4 × 2 - 5 × 3)}{(3 + 4)}, \frac{(4 × 3 + 3 × 8)}{(3+4)}

= (-1, 36/7)

Slope of the given points=(8-3)/(-5-2) =-5/7

Since, the required line is perpendicular to the line joining the given points.

Therefore, the slope of required line 'm' = 7/5

Here, $x_1 = -1, y_1 = 36/7$ & m = 7/5

So, the equation of line is

$\Rightarrow y - 36/7 = 7/5(x - (-1))$

$\Rightarrow y-36/7 = 7/5(x + 1)$

⇒ 49x + 35y + 229 = 0 is the required equation of straight line.

Question 4. Prove that the perpendicular drawn from the point (4, 1) on the join of (2, -1) and (6, 5) divides it in ratio 5:8.

Solution:

Let PO be the perpendicular drawn from P(4,1) on the line joining A(2, -1) and B(6, 5)

Let slope of PO be 'm'

According to question

m × Slope of AB = -1

⇒ m × (5 + 1)/(6 – 2) = -1

⇒ m × 6/4 = -1

⇒ m = -4/6 = -2/3

Thus, the equation of line PO

x1 = 4, y1 = 1 & m = -2/3

(y – 1) = -2/3(x – 4)

⇒ 3y – 3 = -2x + 8

⇒ 2x + 3y – 11 = 0 ——(1)

Let O divide the line AB in the ratio of K:1

Then the coordinates of O are \frac{(6k + 2)}{(k + 1)}, \frac{(5k - 1)}{(k + 1)}

Since point O lies in the line AB

Therefore, it satisfies the equation (1)

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$\Rightarrow 12k + 4 + 15k - 3 - 11(k + 1) = 0$

$\Rightarrow 27k - 11k + 1 - 11 = 0$

$\Rightarrow 16k = 10$

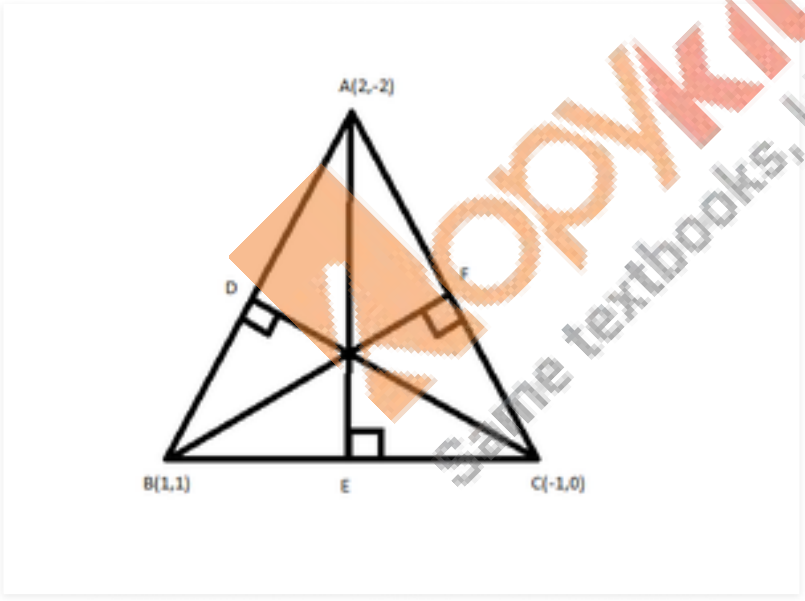
$\Rightarrow k = 5/8$

Hence Proved

Question 5. Find the equation to the altitudes of the triangle whose angular points are A(2, -2), B(1, 1), and C(-1, 0).

Solution:

Let the altitudes be AE, BF and CD



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Slope of AE × Slope of BC = -1 [Since both lines are perpendicular to each other]

Slope of AE = (-1) / Slope of BC

Slope of AE = $\frac{(-1)}{\frac{(0-1)}{(-1-1)}}$

=

Equation of the altitude AE

y − (-2) = (-2)(x − 2)

⇒ y + 2 = -2x + 4

⇒ 2x + y − 2 = 0

Similarly,

Slope of BF × Slope of AC = -1

Slope of BF = $\frac{(-1)}{[\frac{(0-(-2))}{(-1-2)}]}$

= $\frac{-1}{\frac{2}{-3}}$

= 3/2

Equation of the altitude BF

y − 1 = (3/2)(x − 1)

⇒ 2(y − 1) = 3x − 3

⇒ -3x + 2y − 2 + 3 = 0

⇒ 3x − 2y − 1 = 0

Slope of CD × Slope of AB = -1

Slope of CD= $\frac{-1}{\frac{(1-(-2))}{(1-2)}}$

= $\frac{-1}{\frac{3}{-1}}$

= 1/3

Equation of the altitude CD

y − 0 = (1/3) (x − (-1))

⇒ 3y = x + 1

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Question 6. Find the equation of the right bisector of the line segment joining the points (3, 4) and (-1, 2).

Solution:

Let the points of the line segment be A(3, 4) and B(-1, 2)

Let the right bisector meet at point 'P' on the line segment

Coordinates of point P = \frac{(3-1)}{2}, \frac{(4+2)}{2} [Using the mid point formula]

= (1, 3)

Slope of AB = [(2 – 4) / (-1 – 3)]

=-2/-4

= 1/2

Slope of right bisector = $\frac{-1}{(\frac{1}{2})}$

= -2

Equation of the right bisector

⇒ y – 3 = -2(x – 1)

⇒ y – 3 = -2x + 2

⇒ ***2x + y – 5 = 0*** *is the required equation of the right bisector*

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Question 7. Find the equation of the straight line passing through the point (3, -2) and making an angle of 60° with the positive direction y-axis.

Solution:

t makes an angle of 30° with the positive direction of x-axis as shown in the diagra m.

Slope of line 'm'= tan 30° = 1/√3

Equation of straight line passing through (3, -2)

y − (-2) = 1/√3(x − 3)

⇒ √3(y + 2) = x − 3

⇒ √3y + 2√3 = x − 3

⇒ ***x − √3y − 3 − 2√3 = 0*** *is the required equation of straight line.*

Question 8. Find the equation of the straight line which passes through the point (1, 2) and makes an angle with the positive direction of x-axis whose sine is 3/5.

Solution:

Given, sin θ = 3/5

tan θ = 3/√(25 − 9) = 3/4

Slope of the line m = 3/4

Equation of straight line passing through (1, 2)

y − 2 = 3/4(x − 1)

⇒ 4(y − 2) = 3x − 3

⇒ 4y − 8 = 3x − 3

⇒ ***3x − 4y + 5 = 0*** *is the required equation of straight line.*

uestion 9. Find the equation of the line passing through the point (-3, 5) and

Solution:

Slope of the required equation 'm' = (-1) / [Slope of line joining (2, 5) and (-3, 6)]

[Perpendicular to each other]

$m = \frac{(-1)}{\frac{(6-5)}{(-3-2)}}$

$m = \frac{-1}{\frac{-1}{5}}$

m = 5

Equation of straight line passing through (-3, 5)

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Question 10. Find the equation of the right bisector of the line segment joining the points A(1, 0) and B(2, 3).

Solution:

Let the right bisector meet at point 'P' on the line segment

Coordinates of point P = $\left[\frac{(1+2)}{2}, \frac{(0+3)}{2}\right]$ *[Using the mid point formula]*

= (3/2, 3/2)

Slope of AB = [(3 – 0)/(2 – 1)]

= 3/1 = 3

Slope of right bisector = -1/3

Equation of the right bisector

⇒ y – 3/2 = -1/3(x – 3/2)

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⇒ $x + 3y - 9/2 - 3/2 = 0$

⇒ $x + 3y - 6 = 0$

⇒ ***x + 3y – 6 = 0*** *is the required equation of the right bisector.*

Question 11. Find the lines through the point (0, 2) making angles π/3 and 2π/3 with the x-axis. Also, find the lines parallel to them cutting the y-axis at a distance of 2 units below the origin.

Solution:

Given the line through the point (0, 2) making angles π/3 and 2π/3 with the x-axis

.Slope m1= tan π/3 = √3

Slope m2 = tan 2π/3 = -√3

Equation of the required lines

⇒ $y - 2 = \sqrt{3}(x - 0)$ *and* $y - 2 = -\sqrt{3}(x - 0)$

⇒ ***y – √3x – 2 = 0 and y + √3x – 2 = 0***

Now, the equation of the line parallel to the line having slope m1 and y intercept c= -2

y = m1x + c

⇒ ***y = √3x – 2***

Similarly, the equation of the line parallel to the line having slope m2 and y intercep t c = -2

y= m2x + c

⇒ ***y = -√3x – 2***

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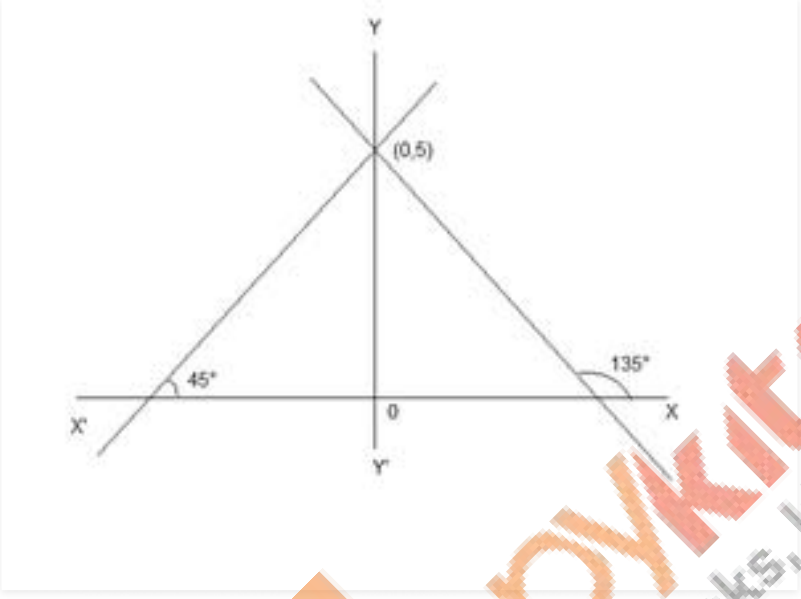
Question 12. Find the equation of the straight lines which cut off an intercept 5 from the y-axis and are equally inclined to the axes.

Solution:

Given that the straight lines cut off an intercept 5 from the y-axis and are equally in clined to the axes.



Slope of the two lines are m1 = tan 45° =1 and m2 = tan 135° = -1

Equation of the required straight lines are

y = m1x + c or y = m2 + c

⇒ y = x +5 or y = -x + 5

⇒ ***y = x +5 or y + x = 5***

Question 13. Find the equation of straight lines which intercepts a length 2 on the positive direction of the x-axis and is inclined at an angle of 135° with the positive direction of y-axis.

lution:

The required line which is inclined at an angle of 135° with the positive direction of y-axis makes an angle of 45° with the positive x-axis.

Slope of the required line m = tan 45° = -1

Equation of the required straight line with x-intercept c = 2 and m = -1

$x = my + c$

$\Rightarrow x = 1y + 2$

$\Rightarrow \boldsymbol{x - y - 2 = 0}$

Question 14. Find the equation of line passing through (0, 0) with slope m.

Solution:

Equation of line passing through (0, 0) with slope m is

$y - 0 = m(x - 0)$

$\Rightarrow \boldsymbol{y = mx}$

Question 15. Find the equation of line passing through (2, $2\sqrt{3}$) and inclined with x-axis at an angle of 75°.

Solution:

Slope of the line m = tan 75°

$= \tan(45° + 30°)$

$= (\tan 45° + \tan 30°)/(1 - \tan 45° \tan 30°)$

$= (1 + 1/\sqrt{3})/(1 - 1/\sqrt{3})$

$m = (\sqrt{3} + 1)/(\sqrt{3} - 1) = 2 + \sqrt{3}$

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$y - 2\sqrt{3} = (2 + \sqrt{3})(x - 2)$

$\Rightarrow y - 2\sqrt{3} = (2 + \sqrt{3})x - 4 - 2\sqrt{3}$

$\Rightarrow \mathbf{(2 + \sqrt{3})x - y - 4 = 0}$

Question 16. Find the equation of the line passing through(1, 2) and making angle of 30° with the y-axis.

Solution:

Let us considered an equation of line passing through points (x_1, y_1) *which making a n angle* θ *with x-axis.*

$(y - y_1) = \tan\theta(x - x_1)$ -(1)

Given: Point = (1, 2), and angle = 30°(with y-axis)

So, angle with x-axis = 90° – 30° = 60°

Now put all these values in eq(1), we get

$(y - 2) = \tan 60°(x - 1)$

$(y - 2) = \sqrt{3}(x - 1)$

$y - 2 = \sqrt{3}x - \sqrt{3}$

$\sqrt{3}x - \sqrt{3} - y + 2 = 0$

$\mathbf{\sqrt{3}x - y - \sqrt{3} + 2 = 0}$

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